Prolonged Treatment of Inappropriate Sinus Tachycardia with Continuous Stellate Ganglion Blockade: A Case Report

Rebecca Christensen, MD,* Emily O. Burzynski, BS,† Sarah R. Vincze, MPH,‡ Edan Bashkin, MD,* Priyanka Shetty, MD,* Pranjali Kainkaryam, MD,‡ and Kevin Finkel, MD‡

Inappropriate sinus tachycardia (IST) presents challenges in diagnosis and treatment due to its unclear etiology and limited therapeutic options. This case report explores the use of continuous stellate ganglion block (CSGB) as a potential treatment avenue. A 23-year-old woman with refractory IST underwent several CSGB placements, resulting in prolonged symptom relief and decreased median heart rate. Despite the eventual recurrence of symptoms, the sustained effects of CSGB suggest its efficacy in managing IST. This report underscores the potential of CSGB as a promising therapeutic approach for IST, offering longer-lasting symptom control compared to single-injection stellate ganglion block (SGB) interventions. (A&A Practice. 2025;19:e01889.)

Inappropriate sinus tachycardia (IST) is a complex syndrome characterized by an unexplained elevation in heart rate above 100 beats per minute at rest or with minimal physical exertion. Common accompanying symptoms include palpitations, dyspnea, fatigue, and presyncope.[1,2] IST affects an estimated 1% of the population, predominantly young women. Diagnosis is difficult as it requires excluding structural heart abnormalities and similar manifesting conditions such as postural orthostatic tachycardia syndrome (POTS), pheochromocytoma, and psychiatric causes.[2,3]

While the exact etiology of IST is unknown, several physiological processes have been postulated including overactivation of cardiac pacemaker funny channels and L-type Ca^{2+} channels, overstimulation of beta receptors, and lack of appropriate muscarinic receptor activity. Potential explanations for sinus rate dysregulation include hormonal changes (eg, pregnancy, aging) or viral infections triggering beta-stimulating adrenergic receptor antibodies.[3] Current pharmacological therapies include beta-blockers, nondihydropyridine Ca^{2+} antagonists, and ivabradine, which selectively inhibits the cardiac funny channel current. Though individually effective, use of these medications can be limited by side effects and the multifactorial nature of IST's pathophysiology.[2,4,5] Consequently, alternative therapies, such as stellate ganglion blocks, are being explored for those who exhibit drug-refractory, highly symptomatic IST.

SGB is a regional anesthetic procedure used to modulate autonomic nervous system activity. Local anesthetic is injected near the sympathetic nerves of the stellate ganglion to reduce sympathetic overactivity and alleviate related symptoms.[6] Typically, a left SGB is administered when treating arrhythmias, as the left stellate ganglion exerts greater sympathetic influence on the myocardium than the right ganglion.[6,7] SGB has been used to successfully treat various forms of medically refractory tachycardia.[6–8] A single-injection SGB provides temporary heart rate control from 5 to 72 hours, whereas continuous infusion may extend symptom relief during placement and potentially for months after.[8–10] However, limited data exist on the efficacy of continuous stellate ganglion block (CSGB) for IST. This case report demonstrates the successful use of CSGBs in a patient with IST to provide long-term symptom relief and heart rate control.

Written consent and Health Insurance Portability and Accountability Act (HIPAA) authorization were obtained from the patient to publish this case report. This manuscript follows the applicable Enhancing the Quality and Transparency of Health Research (EQUATOR) guidelines.

CASE DESCRIPTION

A 23-year-old woman with a complex medical history including median arcuate ligament syndrome, mast cell activation syndrome (MCAS), POTS, tachycardia-triggered hypotension, celiac disease, gastroparesis, and dependence on total parenteral nutrition (TPN) presented to the hospital for palpitations and postural hypotension due to uncontrolled IST. Her IST symptoms were most bothersome when standing and while performing daily activities. Her previous IST treatment history comprised lifestyle adaptation (exercise) and various pharmacologic interventions including alpha-adrenergic agonists (midodrine, clonidine), ivabradine, normal saline boluses, and desmopressin. Other treatments, like beta-blockers, were contraindicated due to her worsening MCAS. TPN was later initiated due to celiac disease and poor response to oral intake (nausea, vomiting, and malabsorption), preventing further oral medication use. Prior anesthetic interventions included 2 single-injection

From the *Integrated Anesthesia Associates, Department of Anesthesia, Bone & Joint Institute and Hartford Hospital, Hartford, Connecticut; †Medical University of Warsaw, Department of Medicine, Warsaw, Poland; and ‡Integrated Anesthesia Associates, Department of Anesthesia, Hartford Hospital, Hartford, Connecticut.

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Address correspondence to Sarah R. Vincze, MPH, Department of Anesthesia, Hartford Hospital, 80 Seymour St, Jefferson Building 321, Hartford, CT 06102. Address e-mail to sarah.vincze@hhchealth.org.

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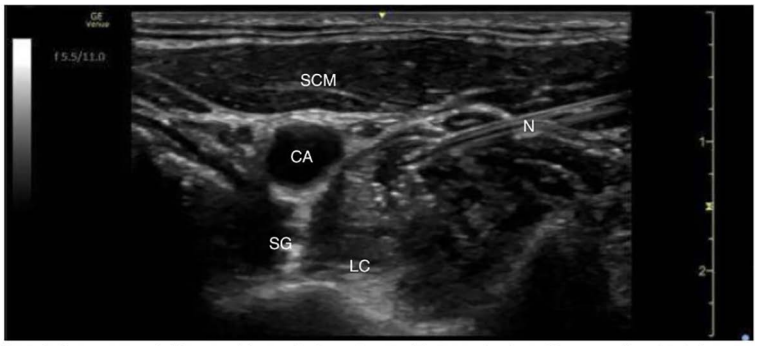
SGBs (0.5% bupivacaine [10 mL]) administered 6 weeks apart, each resulting in symptom control for approximately 1 week. CSGBs were explored to extend symptom relief beyond that observed with single-injection blocks.

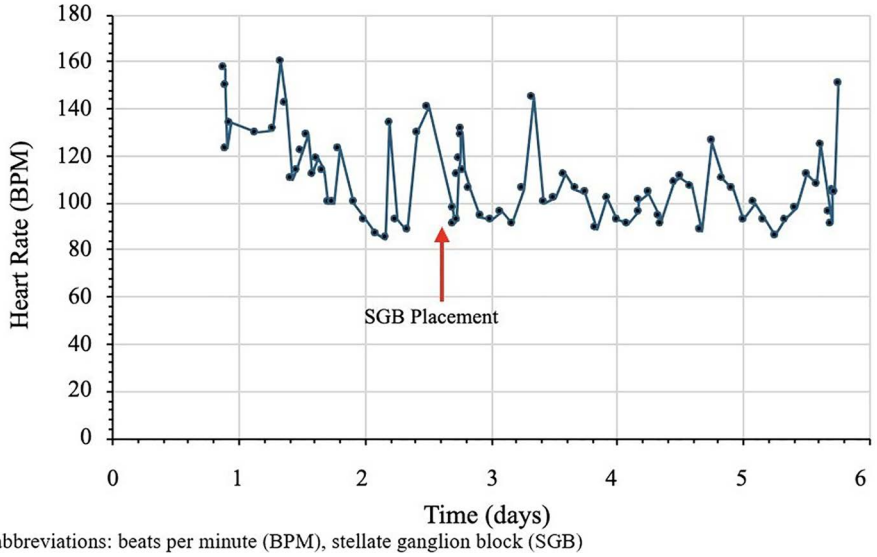
After presenting to the emergency department with palpitations, the patient was admitted for prolonged symptom relief. During the hospitalization, a left CSGB was placed for 3 days. The area was draped and prepped with betadine (due to a chlorhexidine allergy) in sterile fashion. Using ultrasound guidance, good visualization of the internal carotid artery and longus coli muscle was achieved; a clear path was visualized without blood vessels or nerves (Figure 1). An 18G 51mm needle was advanced in-plane with frequent negative aspiration to confirm the needle was not in a vascular structure, until the tip approximated the superior border of the longus coli muscle. After confirmation of tip placement with sterile saline, 10mL of 0.5% bupivacaine was administered under low-pressure injection with negative aspirations every 2 to 3 mL. A Pajunk catheter was placed above the longus coli with visualization and further injection of saline under ultrasound before taping in place. A continuous infusion of 4mL/hr of 0.2% ropivacaine was administered, with the expected Horner's syndrome prevalent throughout catheter use, indicated by a left-sided ptosis and miosis. The patient denied any negative side effects related to the Horner's Syndrome, including vertigo, double vision, arm pain or weakness, or hoarseness. Conversely, she reported feeling better and noticed a reduction in palpitations and perceptible tachycardia. Additionally, there was a significant reduction in heart rate during the 3 days of catheter placement (Wilcoxon rank-sum test, median [IQR]: 114 [93–131] vs 102 [94–106], $P = .0125$; Figures 2 and 3 SGB#1). The patient also reported 7 weeks of symptom relief after discharge, although no method was used to objectively document her heart rate.

During a hospital admission 6 months later for an unrelated infection, she received another CSGB for 7 days. The procedure and dosing were the same as the previous procedure, with left-sided Horner's syndrome present throughout. Months later, the patient underwent a scheduled admission for IST symptom relief, during which another CSGB was placed for 3 days, but prematurely removed due to loss of Horner's syndrome and leaking around the insertion point. During both follow-up CSGB placements,



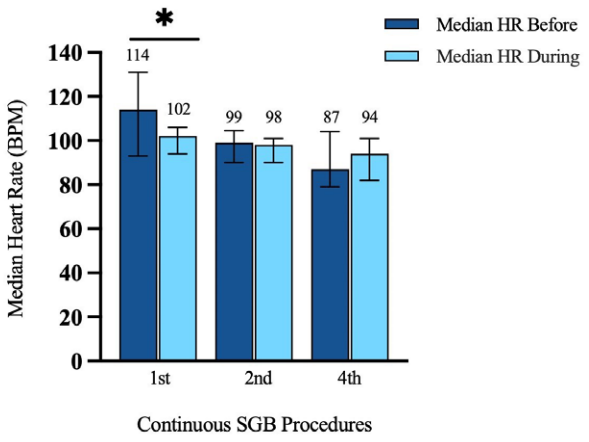
abbreviations: sternocleidomastoid muscle (SCM), carotid artery (CA), stellate ganglion (SG), longus coli muscle (LC), needle (N).

Figure 1. Ultrasound image of first CSGB placement. CSGB indicates continuous stellate ganglion block.



abbreviations: beats per minute (BPM), stellate ganglion block (SGB)

Figure 2. Visualization of heart rate before and during the first SGB catheterization. A red arrow indicates time of CSGB placement. CSGB indicates continuous stellate ganglion block; SGB, stellate ganglion block.



abbreviations: stellate ganglion block (SGB), heart rate (HR), beats per minute (BPM)

Figure 3. Median heart rate before and during continuous SGB. Values are presented as median heart rate ± interquartile range. Statistical significance (*$P < .05$) was observed in the comparison of median heart rate before and during treatment. SGB indicates stellate ganglion block.

the patient noted reduced symptoms and fewer palpitations, noting reflex tachycardia only when moving from sitting to standing. A single-injection SGB was administered a month later due to multiple aberrant vascular structures observed on ultrasound, precluding another continuous block placement.

DISCUSSION

We present the successful use of continuous stellate ganglion blockade to treat IST in a unique scenario where conventional treatment modalities were contraindicated. During CSGB placement, the patient reported relief from tachycardia-associated symptoms, which persisted for 7 weeks after block discontinuation. Additionally, her median heart rate was significantly reduced during the first CSGB.

SGBs have been increasingly used in clinical practice to treat heart rhythm disorders by reducing excessive sympathetic outflow that causes increased or irregular heart rate.[8] While single-injection SGB is more common, CSGBs have shown promise in sympathetic nervous system modulation.[7,10,11] One study reported diminished paroxysmal sympathetic hyperactivity symptoms in a patient with severe brain trauma for 140 days after CSGB placement.[10] In another report, a pregnant woman with refractory ventricular fibrillation received CSGB and reported decreased chest pain for 12 days without episodes of defibrillation, prolonging gestation long enough for viable and complication-free cesarean delivery.[11] Due to differing causes of sinus node dysregulation in these cases compared to this patient with IST, direct comparison is not feasible. Still, our patient reported approximately 7 weeks of symptom relief after CSGB placement, similar to the extended relief seen in these other cases. Importantly, symptom relief lasted significantly longer than the average 5 to 72 hours typically observed with a single SGB.[7,9]

While CSGB is not a cure, it may offer longer-term IST symptom relief when clinically appropriate. The existing IST treatment regimen consists of lifestyle changes, medications, and catheter ablation, which not all patients qualify for or respond to. Sinus node catheter ablation was considered for this patient, but the potential for longer lasting and possibly permanent side effects, such as progressive hemodynamic instability and phrenic nerve paralysis, led her to refuse.[3,4] CSGB poses lower risks of permanent complications due to its temporary effects and is favored when stability is critical.[3] Due to this patient's dependence on TPN, oral medications like ivabradine were unsuitable, prompting alternative use of CSGB.

There are several limitations to using CSGB for IST. This continuous anesthetic block must be administered and monitored in an acute care setting. CSGB can be associated with complications including bleeding around the incision site and loss of sympathectomy, as observed in this patient. Other complications include appreciable risk of catheter dislodgment from head and neck movement, infection risk, and hematoma formation.[6,7] SGBs are performed in a highly vascularized area of the neck, which can pose a hazard when advancing a large bore needle; repeated blocks can also alter the vasculature appearance, presenting a feasibility and safety challenge for reuse, as occurred in our patient.[7]

Despite these challenges, the patient achieved prolonged symptom relief and heart rate control after CSGB placement. The treatment was beneficial for symptom management from the patient's perspective and a significant decrease in median heart rate occurred during the first CSGB placement. Interestingly, the patient's median heart rate remained similar to that reported after the first block placement before and during subsequent CSGB placements (Figure 3), suggesting a potential long-term reduction effect. While the patient reported 7 weeks of symptom relief after the first CSBG, no objective heart rate data were obtained postdischarge. Heart rate monitoring using a Holter monitor should be incorporated in future studies to obtain objective heart rate data and evaluate the long-term effects of CSGB. Further research is needed to weigh the benefits versus risks of CSGB for IST treatment in multi-patient studies. Though not considered for this patient, radiofrequency ablation of the stellate ganglion has also shown promise for longer term symptom relief from refractory, ventricular disease,[12] and chronic pain.[13–15] Both stellate ganglion neuro-modulatory approaches could potentially offer longer-lasting symptom relief for individuals with refractory IST or contraindications to conventional treatment modalities, warranting their further exploration as treatment strategies for IST.

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